

## Lesson 2: Teaching Activities

### Introduction (to establish prior knowledge)

- Names of some famous bridges.
- The effect that bridges have on communities.
- Name the types of the 3 bridges on the Forth near Edinburgh, Scotland – Cantilever, Suspension and Cable Stay bridge.
- The importance of World Heritage status.
- Why is the Queensferry Crossing unique?
- The importance of shape, symmetry and scale play to the bridge building process.
- Materials used in bridge construction – past and present.

### Learning

- Divide the class into the same 3 groups as per previous lesson (i.e. their 'bridge' group).
- Tell pupils they are going to find out as many facts as possible about their bridge, i.e.
  - Forth Bridge (Cantilever).
  - Forth Road Bridge (Suspension).
  - Queensferry Crossing (Cable Stay).
- **Individually**, pupils research their allocated bridge type and write down as many short facts as they can (minimum of 6-10 facts) about their bridge type (one fact per post-it).

**Note:** Dictionaries should be made accessible to support pupils' understanding of facts read and in order that they can, more easily, rewrite them in their own words.

Possible key word/phrases that could be researched using a search engine:

- Facts about Forth Bridge/Forth Road Bridge/Queensferry Crossing.
- How do Suspension, Cantilever and Cable Stay bridges work?
- Materials used in the construction of the Forth Bridge/Forth Road Bridge/Queensferry Crossing.

**Tell pupils these facts will be kept for a follow up lesson.**

### Plenary

Pupils share ONE interesting fact about their bridge with a peer from the same research group. Peer asks questions about the fact to reinforce thinking and ensure understanding.

## Lesson 3: Delivering a Presentation – Cooperative Learning – ‘Expert’ Groups

Four Feature Lesson Plan      Level: Second

Experiences and Outcomes	Term
<p><b>LIT 2-09a</b> When listening and talking with others for different purposes, I can:</p> <ul style="list-style-type: none"> <li>• share information, experiences and opinions.</li> <li>• explain processes and ideas.</li> <li>• identify issues raised and summarise main points or findings.</li> <li>• clarify points by asking questions or by asking others to say more.</li> </ul> <p><b>TCH 1-04a / TCH 2-04a</b> I explore and experiment with the features and functions of computer technology and I can use what I learn to support and enhance my learning in different contexts.</p> <p><b>TCH 1-04b / TCH 2-04b</b> I can create, capture and manipulate sounds, text and images to communicate experiences, ideas and information in creative and engaging ways.</p> <p><b>LIT 2-10a / LIT 3-10a</b> I am developing confidence when engaging with others within and beyond my place of learning. I can communicate in a clear, expressive way and I am learning to select and organise resources independently.</p>	
<p><b>Planning for Assessment (What will you be assessing? Assessing the learning can happen at the beginning, middle and end)</b></p>	
<p><b>SAY:</b> Individuals will ask relevant questions to clarify points.</p>	<p><b>MAKE:</b> Groups of pupils make a presentation to the rest of the class.</p>
<p><b>WRITE:</b> Pupils take notes/sketch how their final presentation will look.</p>	<p><b>DO:</b> Pupils will:</p> <ul style="list-style-type: none"> <li>• listen while someone else is talking.</li> <li>• share knowledge with others.</li> <li>• work collaboratively.</li> </ul>

### **Lesson 3: Delivering a Presentation – Cooperative Learning – ‘Expert’ Groups**

**EVALUATION AND REVIEW:** Indication of overall success, group or individual progress or further reinforcement required.



## Lesson 3: Teaching Activities

### Learning Intentions

1. Academic Task Pupils will be able to produce a group presentation.
2. Social Task Pupils will be able to work collaboratively by taking turns while talking and listening.

### Success Criteria (written as 'I can' statements)

I can:

- share my knowledge with others.
- listen while someone else is talking.
- ask relevant questions to clarify points made.
- work collaboratively to produce a presentation.

### Resources

- A3 paper.
- Access to computers (Powerpoint).
- A2/A4/A3 paper/card/images from computers (depending on poster layout or oral presentation).
- Paper or access to Word Processing on computers (Rap).

## Lesson 3: Teaching Activities

### Introduction – Connect prior learning

- Whole class discussion about any **challenges** they came across in carrying out the research, e.g.
  - the ability to choose appropriate websites.
  - understanding the text in order to put it into their own words.
  - being able to explain their fact if asked a question by a peer.
- Teacher asks some pupils to read out a fact to the whole class.
- Others ask questions about the fact to seek clarification.

**Note:** This is a necessary teaching step/opportunity and should not be missed out! **It will allow pupils to see the importance placed on understanding the facts they have written, as well as the importance of being able to explain what they mean, if asked a question during/after their final presentation.** Pupils will take this learning into the group activity, where group members can support each other with further explanations and knowledge in preparation for the final presentation. Use of dictionaries, etc. should be encouraged if necessary.

### Learning

- Working groups are formed, according to the bridge researched. (Large groups should be subdivided with a maximum of 5 per group).
- Provide each group with an A3 sheet of paper.
- Pupils place the post-it notes separately with their facts from Lesson 2 in front of them.
- Taking turns, pupils say, then place, one of their facts on the A3 sheet. **(Peers ask questions to seek clarification if necessary).**
- Working in a clockwise direction, pupils read one of their facts out loud. The group determines whether the fact is different or similar to another. If it is similar, it is placed ON TOP of its counterpart. If it is different, it is placed BESIDE and **again questions are asked to seek clarification if necessary.**
- This continues until each fact is placed on the A3 paper.
- Having ensured that no facts are repeated, each group decides the best way to present their 'expert' knowledge of their bridge type to the rest of the class, e.g.
  - poster.
  - oral presentation.
  - rap.
  - PowerPoint presentation.
- Pupils plan and give a group presentation.
- At the end of each 'expert' presentation others may ask questions to have information clarified.

## Lesson 3: Teaching Activities

### Plenary

- Group Processing:
  - Groups discuss if they achieved the Learning Intentions, i.e. Academic and Social tasks/skills.
  - Identify improvements that could be made to each.
- Group Feedback:
  - Feedback from each group to see what they have learned/achieved against Success Criteria.

## Lesson 4: Formulating Questions to Deepen Understanding about the Queensferry Crossing

Four Feature Lesson Plan      Level: Second

Experiences and Outcomes	Term
<p><b>LIT 2-26a</b> By considering the type of text I am creating, I can select ideas and relevant information, organise these in an appropriate way for my purpose and use suitable vocabulary for my audience.</p>	
<p><b>Planning for Assessment (What will you be assessing? Assessing the learning can happen at the beginning, middle and end).</b></p>	
<p><b>SAY:</b> Individuals will be able to discuss the relevance of questions.</p>	<p><b>MAKE:</b> Groups of pupils will be able to make a categorised list of questions and place them in order of importance.</p>
<p><b>WRITE:</b> Pupils will write questions for a given purpose using appropriate vocabulary.</p>	<p><b>DO:</b> Pupils will:</p> <ul style="list-style-type: none"> <li>• talk in quiet voices.</li> <li>• listen while someone else is talking.</li> <li>• work collaboratively.</li> </ul>
<p><b>EVALUATION AND REVIEW OF LESSONS 1 – 4:</b> (Indication of: overall success including group progress, individuals' progress and/or group/individual Next Steps).</p>	

## Lesson 4: Teaching Activities

### Learning Intentions

1. Academic Task: In groups pupils will be able to produce a diverse range of questions they would like answered about the Queensferry Crossing, including comparative questions about the Forth Bridge and Forth Road Bridge.
2. Social Task: Pupils will be able to talk in quiet voices while working collaboratively.

### Success Criteria (written as 'I can' statements)

I can:

- formulate questions to deepen my understanding of the bridge building process.
- talk in a quiet voice while working collaboratively with others.

### Resources

- A3 paper.
- Post-it notes.

### Introduction (to establish prior knowledge)

- Ask a pupil from each 'bridge type' group to recap on one/two of the main points made from their presentation.
- Tell pupils that during their visit to the Contact and Education Centre, they will be given the opportunity to have all other questions they may have about the Queensferry Crossing, including comparative questions about Forth Bridge and Forth Road Bridge, answered by engineers.
- Tell pupils that they are going to be given the opportunity to formulate their own the questions and that these will be sent to the centre prior to the visit so that the engineers can be well prepared!
- Tell pupils that questions will need to be collated, however, so that the same questions are not repeated.
- Tell pupils they are going to do this in the same 'Cooperative Learning' groups as before.



## Lesson 4: Teaching Activities

### Learning

- Discuss Learning Intentions and Success Criteria with the class.
- Discuss the 'Plenary' from Lesson 3 i.e. identify the improvements that could have been made to both Academic and Social tasks.
- Ask pupils for examples of some questions they would like answered.

**Note:** Further questions by pupils will obviously depend on information gleaned from group presentations. Although pupils' creativity in asking questions should not be stifled, below is a list of questions that teachers may wish to use to 'guide' thinking. Some of these will allow comparisons to be made between the Queensferry Crossing, the Forth Bridge and Forth Road Bridge. Example:

- |   |  |   |
|---|--|---|
| - Why was it decided to build the bridge? | - Amount of traffic that crosses each day?                           | - How is it connected to roads?   |
| - How long did construction take?         | - Number of rivets used?   | - Where did it get its name?  |
| - How much did it cost to build?          | - How is the bridge supported?                                       | - Who designed it?  |
| - Length?                                 | - How do viaducts/towers/decks work?                                 | - The importance of the weather forecast for the bridge itself/traffic. |
| - Materials used to build the bridge?     | - What are the biggest challenges in building viaducts towers/decks? | - What do surveyors/engineers do?                                       |
| - Quantity/ weight of steel used?         | - Amount of people employed on the project?                          | - How important is it that everyone works as part of a team?            |
| - Volume of concrete used?                | - Day to day maintenance? e.g. corrosion, painting?                  |   |
| - How does the bridge hold its weight?    | - Effect on local and wider community?                               |   |
| - Quantity/weight of wire used?           | - Effect on Scotland as a country?                                   |   |
| - Height of towers?                       |  |   |

## Lesson 4: Teaching Activities

- The same Co-operative Learning groups are formed as per Lesson three.
- Provide each group with post-its and an A3 sheet of paper.
- Each pupil writes a maximum of five questions – one question per post-it note. (Note: Giving pupils a maximum number of questions will give them the opportunity to focus on the validity of their question).
- Pupils place the post-it notes with their questions in front of them.
- Taking turns, pupils say, then place, one of their questions on the A3 sheet.
- Working in a clock-wise direction, pupils read one of their questions out loud. The group determines whether the question is different or similar. If it is similar it is placed ON TOP of its counterpart. If it is different it is placed beside.
- This continues until each question is placed on the A3 paper.

## Lesson 4: Teaching Activities

**Note:** This next stage in the learning process is at the discretion of the class teacher. It depends on class size and therefore the overall number of questions that have been proposed by the class at large. Ideally no more than fifteen to twenty questions should be asked while at the Contact and Education Centre. Questions proposed from each group, therefore, should be categorised and numbered in order of importance/the most valid. This is an excellent opportunity for pupils to discuss the reasons 'why' some questions may be better than others.

- Since individual groups may have similar questions this stage is to further streamline. Working as a whole class, the teacher asks Group 1 to read out their top question. This is written on the whiteboard. Working in a clock-wise direction, a pupil from each group reads out their groups' top question. The class determines whether the question is different or similar. If it is similar it is dismissed. If it is different it is written on the whiteboard.
- This process continues with question two etc until fifteen to twenty questions have been written on the whiteboard.

**Note:** Any remaining questions can be collected and collated by the teacher if deemed necessary. Questions should be typed up and sent to the Contact and Education Centre. Email: [fr enquiries@transportscotland.gsi.gov.uk](mailto:fr enquiries@transportscotland.gsi.gov.uk) and title the email **YOUR SCHOOL NAME SCHOOL VISIT QUESTIONS**.

- Using an image of the Forth Rail bridge, 'bridge' groups identify the names of mathematical shapes e.g. angles, symmetry, etc. used in the bridge building process.
- Using an image of the Forth Road bridge, 'bridge' groups identify the names of mathematical shapes e.g. angles, symmetry, etc. used in the bridge building process.
- Using an image of a Cable Stay bridge, 'bridge' groups identify the names of mathematical shapes e.g. angles, symmetry, etc. used in the bridge building process.
- Groups present their findings and hypotheses to the rest of the class.

(The teacher may wish to expand on each group's conjectures).

### Final Activity

Pupils draw the bridge from their 'bridge' group, paying particular attention to shape, scale and symmetry.

**Note:** If the discussion was done as a whole class activity the class should now be divided into 3 groups, each with a bridge to draw.

## Pre-Engineering Challenge Lessons Experiences and Outcomes: Lessons 1 – 4

SOC = Social Studies

TCH = Technology

MTH = Maths

LIT = Literacy

EXA = Expressive Arts

### Lesson 1

#### SOC 2-13a

I can explain how the physical environment influences the ways in which people use land by comparing my local area with a contrasting area.

#### TCH 2-01b

I can investigate how an everyday product has changed over time to gain an awareness of the link between scientific and technological developments.

#### MTH 2-16a

Having explored a range of 3D objects and 2D shapes, I can use mathematical language to describe their properties and, through investigation, can discuss where and why particular shapes are used in the environment.

#### LIT 2-09a

When listening and talking with others for different purposes, I can share information, experiences and opinions.

#### EXA 2-03a

I can create and present work that shows developing skill in using the visual elements and concepts.

### Lesson 2

#### TCH 2-03b

Throughout all my learning, I can use search facilities of electronic sources to access and retrieve information, recognising the importance this has in my place of learning, at home and in the workplace.

#### LIT 2-15a

I can make notes... ( ) and use them to understand information, develop my thinking, explore problems and create new texts, using my own words as appropriate.

### Lesson 3

#### LIT 2-09a

When listening and talking with others for different purposes, I can:

- share information, experiences and opinions;
- explain processes and ideas;
- identify issues raised and summarise main points or findings;
- clarify points by asking questions or by asking others to say more.

#### TCH 1-04a / TCH 2-04a

I explore and experiment with the features and functions of computer technology and I can use what I learn to support and enhance my learning in different contexts.

#### TCH 1-04b / TCH 2-04b

I can create, capture and manipulate sounds, text and images to communicate experiences, ideas and information in creative and engaging ways.

#### LIT 2-10a / LIT 3-10a

I am developing confidence when engaging with others within and beyond my place of learning. I can communicate in a clear, expressive way and I am learning to select and organise resources independently.

### Lesson 4

#### LIT 2-26a

By considering the type of text I am creating, I can select ideas and relevant information, organise these in an appropriate way for my purpose and use suitable vocabulary for my audience.

Pupils should now be better equipped with the background knowledge and understanding to:

- take on the engineering challenges during a visit to the Contact and Education Centre.

or

- take on the Outreach engineering challenges in class with teacher.

## Post-Engineering Challenge Lessons Experiences and Outcomes: Lessons 1 – 4

SOC = Social Studies

TCH = Technology

MTH = Maths

LIT = Literacy

EXA = Expressive Arts

### Lesson 1

#### LIT 2-02a

When I engage with others, I can respond in ways appropriate to my role, show that I value others' contributions and use these to build on thinking.

#### TCH 1-14a / TCH 2-14a

Through discovery and imagination, I can develop and use problem-solving strategies to construct models.

#### MTH 2-16b

Through practical activities, I can show my understanding of the relationship between 3D objects and their nets.

### Lesson 2

#### MNU 2-03a

Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.

#### TCH 1-14b / TCH 2-14b

Having evaluated my work, I can adapt and improve, where appropriate, through trial and error or by using feedback.

### Lesson 3

#### EXA 0-01a / EXA 1-01a / EXA 2-01a

I have experienced the energy and excitement of presenting/performing for audiences and being part of an audience for other people's presentations/performances.

#### EXA 0-05a / EXA 1-05a / EXA 2-05a

Inspired by a range of stimuli, I can express and communicate my ideas, thoughts and feelings through activities within art and design.

#### TCH 1-03b

I can access, retrieve and use information from electronic sources to support, enrich or extend learning in different contexts.

### Lesson 4

#### TCH 2-12a / TCH 3-12a

By applying my knowledge and skills of science and mathematics, I can engineer 3D objects which demonstrate strengthening, energy transfer and movement.

#### TCH 1-14a / TCH 2-14a

Through discovery and imagination, I can develop and use problem-solving strategies to construct models.